Are you ready?

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2
YOUR MATERIALS

2x COINCELL BATTERIES

This small battery can provide power and fit in tight places. You can connect this to your circuit for power—just make sure that the positive side connects to the positive end and the negative side (or ground) connects to the negative end.

1x SEWABLE COINCELL BATTERY HOLD-

You also have a sewable battery holder in your kit, with conductive holes marked as positive and negative. When inserting your battery in the holder make sure the side with the “+” is facing up and the unmarked side (sometimes perforated) is facing down.

2x SEWABLE LEDS

The LEDs in your kit are smaller surface mount LEDs, so the positive and negative sides are marked next to the silver holes you will use to sew the LED on.
YOUR MATERIALS

**1x CROSS STITCH CLOTH**

This is your prototyping canvas. The holes in the cloth help you sew the thick conductive thread through the cloth. You can draw and stitch your favorite fabric circuit design onto this cloth!

**1x SPOOL OF CONDUCTIVE THREAD**

This thread has silver strands which are conductive. The silver in the thread lets electrons pass through the thread and allows it to carry or transmit power and signals through a circuit. Steel is another metal commonly used to make conductive thread.

**4x FABRIC SNAPS**

These can be used to hold pieces of fabric together like buttons, or you can sew them into circuit and use them as a switch!
YOUR MATERIALS

1x SEWING NEEDLE

This is what you will use to sew your project together. Be careful, the needle has a sharp point!

1x EMBROIDERY HOOP

(Retail box version only)
This is a tool used to hold fabric in place. To use: unscrew the bolt so the rings come apart, then place your fabric flat in between them and tighten the bolt. We recommend you practice sewing with your hoop, and then take apart the project and sew the lights on a new piece, unless you are an experienced seamstress.
### Additional Tools and Materials

Here is a list of tools and supplies that complement your set. We also encourage you to combine this set with other Teknikio sets.

#### Materials and Tools
- Fabric and Thread
- Cotton Stuffing
- Sewing needle/machine
- Scissors

#### Optional Materials
- Velcro
- Paper
- Cardboard
- Scrap metal and plastic
- Beads and sequins

#### Optional Tools
- Wire cutters/stripers
- Glue/hot glue
- Multimeter

Ready to learn?
This guidebook teaches you how to sew light circuits into your own creations.

“Basic Circuits”
The next section will provide a review of basic electronics and how a circuit works.

Things to remember:

A CIRCUIT IS ALWAYS A LOOP.

ELECTRICITY FLOWS FROM POSITIVE TO NEGATIVE AROUND THE LOOP.

EVERYTHING IN THE CIRCUIT MUST BE ORIENTED IN THE SAME DIRECTION FOR THE CIRCUIT TO WORK.

ANYTIME A COMPONENT IS PUT INTO THE CIRCUIT BACKWARDS, IT CAUSES A BREAK IN THE CIRCUIT, MEANING IT BREAKS THE LOOP.

ELECTRICITY WILL ALWAYS TAKE THE PATH OF LEAST RESISTANCE.
CROSS-STITCH SWITCH

OUTPUT
The output, or part that is powered in a circuit. The LEDs and buzzer are loads in your kit.

RESISTANCE
Restricts the rate at which electrons flow through the circuit. Conductive materials have different resistances.

CIRCUIT
The flow of electrons across the circuit, carried by conductive materials, measured in amps.

POWER SOURCE
Provides power to the circuit. Yours is the coin cell battery.

SWITCH
Closes and opens a break in the circuit.
This will drain or “burn out” your battery very quickly. You should always make sure there are no short circuits in your design.

If you were to connect the circuit line in the diagram to the left, the current will flow through the shorter (yellow) path and skip the path that connects to the LED.

This will result in a short circuit—a short circuit is basically equivalent to connecting from the positive end of the power source to the negative, without putting anything in between.

This will drain or “burn out” your battery very quickly. You should always make sure there are no short circuits in your design.
Basic Sewing
HOW TO THREAD A NEEDLE

Cut some thread. Stick one end of your thread through the eye of the needle.

Pull your thread until it is folded in half on the needle.

Take the two ends of the thread and tie a knot.
Take your Cross Stitch Cloth, your threaded needle, and a Sewable LED.

First, place the LED where you want to sew it onto the cloth.

Then, take your needle and thread and, starting from the back, push your needle through the cloth and the positive or negative pad of the LED.

Loop the thread through the hole and cloth multiple times so the LED is secured tightly.

After looping a few times, push the needle down through the hole next to the LED. Push the needle up through the next hole and repeat up and down until you are done or reach the next thing you want to sew.
USING YOUR EMBROIDERY HOOP

Take your embroidery hoop

Loosen the screw and take the hoops apart

Place your fabric between the hoops

Put the hoops back together and tighten the screw
There are 2 separate pieces of thread in this circuit:

1. Sew one thread between the negative terminal of the negative side of the LED

2. Sew the other thread between the positive side of the battery and the positive side of the LED. It should light up.

The red stitches indicate where the thread ends. Once you get to a red stitch or a hole on the board, tie a knot, cut the thread, and start with a new piece. When you are sewing around a silver hole on the board, make sure to go around it a couple of times to make sure it is tight.
Owl project guide
SEWING YOUR OWL

1. Cut out the owl pattern from the back of this guide onto the fabric of your choice. Make sure you know what each piece is for!

   Place the piece for the beak onto the front body piece and sew it on with non-conductive thread (Shown in blue).

   Sew the wings onto the body with non-conductive thread. So that it lays flat on the front of the owl's body and angles away from the body.
Now take the front body piece and place two Sewable LED lights where you want the eyes. Sew a connection between like you did during your practice between the negative pads on each board. Don’t forget to loop around the eye pads a couple of times.

Always sew the positive side to another positive side and a negative side to another negative side. If you do not do this, your lights will not turn on!

Take your Sewable Coincell Battery Holder and place it as close to the center of the belly as you can. Starting from the negative pad of the second LED that you just attached, sew to the negative pad on the battery. Tie a knot and cut your thread.
SEWING THE CIRCUIT

4. Re-thread your needle if you need. Now sew the two positive holes together on the eyes. Make sure not to touch the thread that connects the negatives to avoid a short circuit. Tie a knot and cut your thread.

5. Next, take the bottom side of one of the snaps and place it on the body below the battery holder to the right. Sew from the positive hole on the battery holder to the snap like in the diagram. Tie a knot and cut your thread.

To sew the snap onto the body, sew in and out around all four holes to secure the snap so it does not move around.
ADD THE BACK AND THE SNAPS

6. Working on the **underside of the wing**, sew the top side of the snap so that it matches up with the bottom snap when connected. Connect this snap with the positive pad on the right LED board. Tie a knot and cut your thread.

7. Now thread your needle with non-conductive thread. Take the belly panel and line it up with the bottom of the front panel. Sew the belly piece over the battery holder, leave a small opening on the top so that you can access the battery!

Take the back body panel and sew the bottom and sides back body piece to attach it to the front panel. They should line up nicely!

**positive to positive, negative to negative!**
After you sew the bottom and sides of the body together, stuff with your cotton stuffing until the owl is as soft or firm as you like.

After you have stuffed your owl, sew the top of his head shut with non-conductive thread so no stuffing spills out.
Your owl is all done! Now all you have to do is make sure it works! Insert the battery into the battery-holder so the positive side is up. Take the wing with the snap and connect it to the snap on the body. The eyes should light up. Replace the battery when necessary by reaching in the belly.

If they don't, refer to troubleshooting on page 21.
Troubleshooting
TROUBLESHOOTING

There are 2 common problems that can break the circuit. The first is that the positive and negative paths are crossing. Make sure none of your paths look like this:

![Diagram of crossed paths]

Then make sure none of the thread coming off the knots on the back of your circuit are touching.

The second common problem is a bad connection. This can happen anywhere your thread is connecting to a board or snap. Make sure all of these connections are tight and that the thread is making good contact with the silver surface on the boards and/or with the snaps.
PATTERN
OWL PATTERN
OWL PATTERN

- Bottom
- Eye
- Wing
- Belly
- Beak